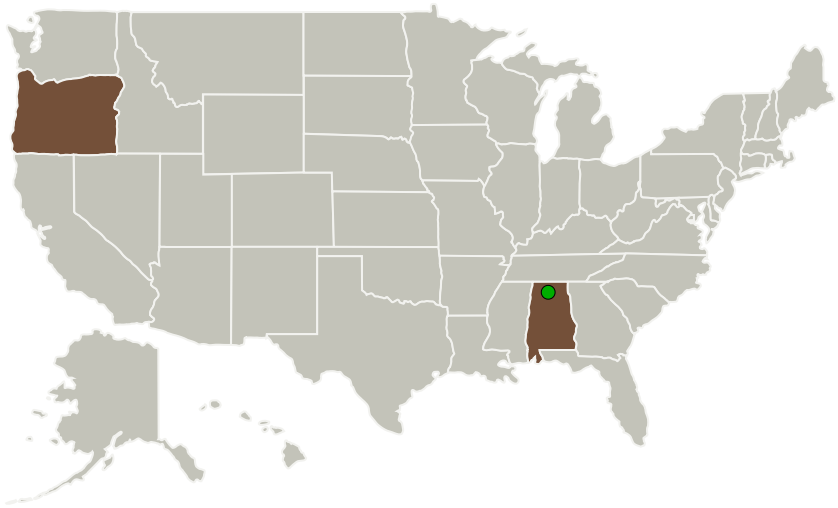
Regenerative Bosch Reactor, Phase I

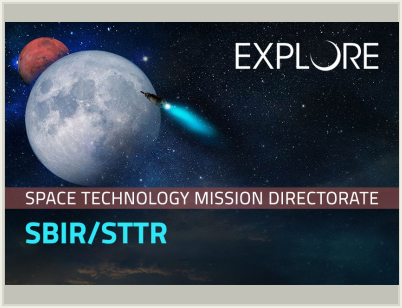
Completed Technology Project (2011 - 2011)

Project Introduction

Oxygen (O2) contained within waste carbon dioxide (CO2) is a vital resource during long-duration, manned missions that must be reclaimed by Environmental Control and Life Support System (ECLSS) hardware. Current CO2 reduction technology to recapture oxygen as water utilizes the Sabatier reaction, in which, two moles of water and one mole of methane are produced for each mole of CO2 reduced. Unfortunately, only half of the hydrogen consumed in the reaction can be recovered by water electrolysis. In contrast, the Bosch reaction produces water and elemental carbon, recovering all hydrogen consumed and closing the O2 - CO2 reduction loop. Previous experience has shown the primary problem with the Bosch reaction is carbon production, which deactivates the catalyst and eventually plugs the reactor. An innovative Regenerative Bosch Reactor (RBR) is proposed to overcome this problem, in which, a bed of small spherical ferromagnetic catalyst beads is periodically agitated using mechanical or magnetic forces to abrade carbon from the catalyst surface. Carbon is expelled from the RBR by the gas stream and collected downstream. The Phase I project will demonstrate catalyst regeneration. A prototype RBR will be designed, assembled, and thoroughly tested during the Phase II program providing NASA with a test bed for independent evaluation. The RBR will improve atmosphere loop closure and lower the ESM for CO2 reduction by recovering all of the hydrogen reductant.

Primary U.S. Work Locations and Key Partners





Regenerative Bosch Reactor, Phase I

Table of Contents

Regenerative Bosch Reactor, Phase I

Completed Technology Project (2011 - 2011)

Organizations Performing Work	Role	Type	Location
UMPQUA Research Company	Lead Organization	Industry	Myrtle Creek, Oregon
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Oregon

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138457)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

UMPQUA Research Company

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

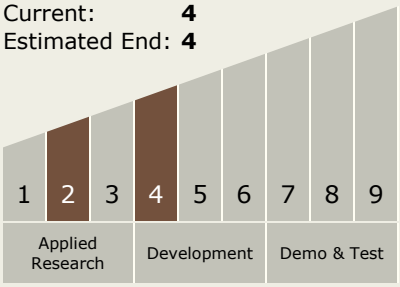
Carlos Torrez

Principal Investigator:

James R Akse

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Regenerative Bosch Reactor, Phase I

Completed Technology Project (2011 - 2011)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.3 Waste Management

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System